

TABLE 5.—Number of hours temperature was 29° and lower by seasons

Station no.	1931		1932		1933		1934		1935		Total		Grand total	5-year average
	April	May	April	May	April	May	April	May	April	May	April	May		
1	36	0			30	0	1	0	53	0	*200	*20	220	44
2	17	0	0	0	72	12	6	0	39	0	86	0	86	17
3	66	1	28	0	15	0	0	0	45	10	215	23	238	48
4	5	0	0	0	75	0	0	0	34	0	64	0	64	11
5	2	0	0	0	2	0	0	0	34	0	38	0	38	8
6	21	0	4	0	40	5	5	0	78	0	148	5	153	31
7	8	0	1	0	17	0	0	0	44	0	70	0	70	14
8	20	0	0	0	18	0	0	0	35	0	73	0	73	15
9	39	0	17	0	42	3	1	0			*110	*2	112	22
10	16	0	3	0	40	2	2	0	44	0	105	2	107	21
11	13	0	2	0	21	0	4	0	49	0	89	0	89	18
12	33	0	21	0	78	6					*208	*21	229	46
13	19	0	9	0							*200	*15	215	43
14	14	0					0	0	41	0	*103	*2	105	21
15											*210	*22	232	46
16	25	0	11	0	75	10	6	0	86	10	203	20	223	45
17	22	0	3	0	45	2	4	0	67	0	141	2	143	29
18	5	0	0	0	17	0	0	0	38	0	60	0	60	12
19	22	0	4	0	34	0	4	0	66	0	130	0	130	26
20	32	0	11	0	32	6	4	0	87	0	167	6	173	35

TABLE 5.—Number of hours temperature was 29° and lower by seasons—Continued

Station No.	1931		1932		1933		1934		1935		Total		Grand total	5-year average
	April	May	April	May	April	May	April	May	April	May	April	May		
21	16	0	4	0	36	0	5	0	67	0	128	0	128	26
22	10	0	2	0	9	2	5	0	51	0	77	2	79	16
23	10	0	0	0	12	1	0	0	46	0	68	1	69	14
24	40	0	6	0	35	0					*115	*4	119	24
25	64	3									*220	*25	245	49
26	1	5	0		34	0					*148	*5	153	31
27		11	0	52	5	4	0	56	0		*161	*2	163	33
28		34	0	0							*230	*30	260	52
29		2	0	0	51	0	2	0	38	0	*105	*0	105	21
30											*85	*0	85	17
31					64	6	10	0	84	10	*220	*20	240	48
32											*230	*30	260	52
33											*65	*0	65	13
34											*100	*1	101	20
35											*100	*1	101	20

*Record interpolated.

Records for the month of March not included in above table.

TORNADO DISASTERS IN THE SOUTHEASTERN STATES, APRIL 1936

By J. B. KINCER

[Weather Bureau, Washington, June 1936]

During the first week of April 1936, two series of disastrous tornadoes occurred in several Southeastern States, the first on April 1-2 and the second on April 5-6. In the first series tornadic storms were reported from 7 cities or towns in Georgia and the Carolinas; in the second the storms were of greater geographic extent, occurring at 17 different places scattered through 6 States, including Arkansas, Tennessee, Mississippi, Alabama, Georgia, and South Carolina. Figure 1 shows the places where tornadoes were reported and the approximate time of the several occurrences.

The atmospheric conditions responsible for these disastrous storms, as shown by the daily synoptic weather maps, are described by Louis P. Harrison, Weather Bureau, Washington, D. C., as follows:

"The two series of storms had their genesis in two different energetic depressions of rather similar nature, each characterized by V-shaped isobars with a trough extending in a south to southwesterly direction, quickly followed by an extensive anticyclone of pronounced high pressure. The tornadoes occurred in connection with the cold fronts which were associated with the troughs of these depressions and passed over the region under consideration during the periods April 1-2, and April 5-6, respectively.

"In each case the front marked the juncture of rather cold, dry, Polar Continental air, overlain in part by Polar Pacific air, advancing southeastward against warm, moist, tropical air, largely from the Gulf of Mexico. These circumstances produced conditions peculiarly favorable for the development of violent local disturbances both of the tornadic and thunderstorm variety, for there existed not only large horizontal temperature gradients across the front, but also remarkably strong vertical gradients through 2 to 5 or more kilometers in the cold-air mass."

The following accounts and descriptions of the storms are based largely on reports by the several Weather Bureau section directors of the States named:

FIRST SERIES, APRIL 1-2, 1936

In this series the first tornado was reported near Tignall, Ga., about 8:30 p. m., April 1, moving in a northeasterly direction. A number of buildings were

ruined, numerous farm animals killed, and at least one person badly injured. The second is reported as occurring about 30 minutes later, at Lincolnton, Ga., some 17 miles southeast of Tignall, moving in a southeasterly direction. The telltale funnel-shaped cloud was reported, and also a rotary wind movement was evident from the position of felled trees. Reports made by the Lincolnton postmaster indicate that about 50 houses were more or less wrecked, but no satisfactory estimate of actual property loss is available. From the description of the movement and time of occurrence of the storm, and the relative geographic location of Tignall to Lincolnton, there were evidently two separate storms in this case.

The next reported occurrence was early the following morning, about 6 a. m., April 2, at Sasser, Ga. This storm moved in a northeastward direction over a path of unknown length, with destructive effects over an area from 200 to 500 yards in width; rotary wind action was evident from the position of the trees overthrown. One Negro man was killed, several people injured, and the property damage was estimated at about \$3,000. The next storm, at Leesburg, Ga., about 10 miles east of Sasser, was reported to have occurred an hour later, or about 7 a. m. Here, eight people were injured and one Negro man killed; property loss was estimated at \$4,300. At 7:30 a. m. of the same day, or half an hour after Leesburg was visited, an exceedingly destructive tornado occurred at Cordele, Ga., in which 23 persons were killed, nearly 500 injured, and property damaged to the amount of \$3,000,000. In addition to the heavy loss of life, the property destruction here was appalling; 287 buildings were demolished, of which 100 were among the best residential homes in the city. Many of the finest houses were torn to splinters, as if blown up by great charges of dynamite.

From the locations of Sasser, Leesburg, and Cordele, and the time of tornado occurrence in each, it is quite likely that the same storm passed through these localities in succession. The time reported at Sasser, or at Leesburg, about 10 miles apart, may not have been accurately given; the first reported "about 6 a. m." and the latter "about 7 a. m."

About an hour after the Cordele disaster, or at 8:30 a. m., a tornado occurred near Lodge, Colleton County,

S. C., some 160 miles northeast of Cordele. One farmer was killed, and farm property valued at \$1,000 destroyed. The movement was from the west over a path about 80 yards wide and 1 mile long.

The first series of storms came to an end at Greensboro, N. C., about 12 hours after the occurrence at Lodge, S. C., when the most destructive tornado of record in North Carolina struck that city soon after 7 p. m. on April 2. Its path was 7 miles long and varied from 50 to 800 feet in width. In its wake the casualties counted included 13 persons killed, 144 injured, and 289 buildings demolished, 56 of which were totally wrecked; property damage is estimated at \$2,000,000. This storm appears to have passed a little north of Mebane at 8 p. m., and was traced in an easterly direction for 6 miles, taking the life of one person, injuring four others, and destroying \$10,000

Waynesboro, Hohenwald, and Columbia; the times of occurrence ranged from 7:45 to 8:30 p. m., April 5. In Hardin County one person was killed and several small buildings damaged. In Wayne County, property damage was heavier, estimated at \$100,000, but no lives were lost. In Lewis County a few people were injured and property lost to the extent of \$50,000, while in Maury County 5 people were killed, 20 others injured, with property loss about \$50,000.

At about the time of the Tennessee tornado, or 8:05 p. m., Booneville, Miss., was visited by a similar storm, when 4 people were killed, 12 injured, and from \$20,000 to \$30,000 worth of property destroyed. Also, at nearly the same time, another appeared at Coffeyville, Miss., about 80 miles southwest of Booneville, at 8:10 p. m., with the loss of four lives, seven people injured, and

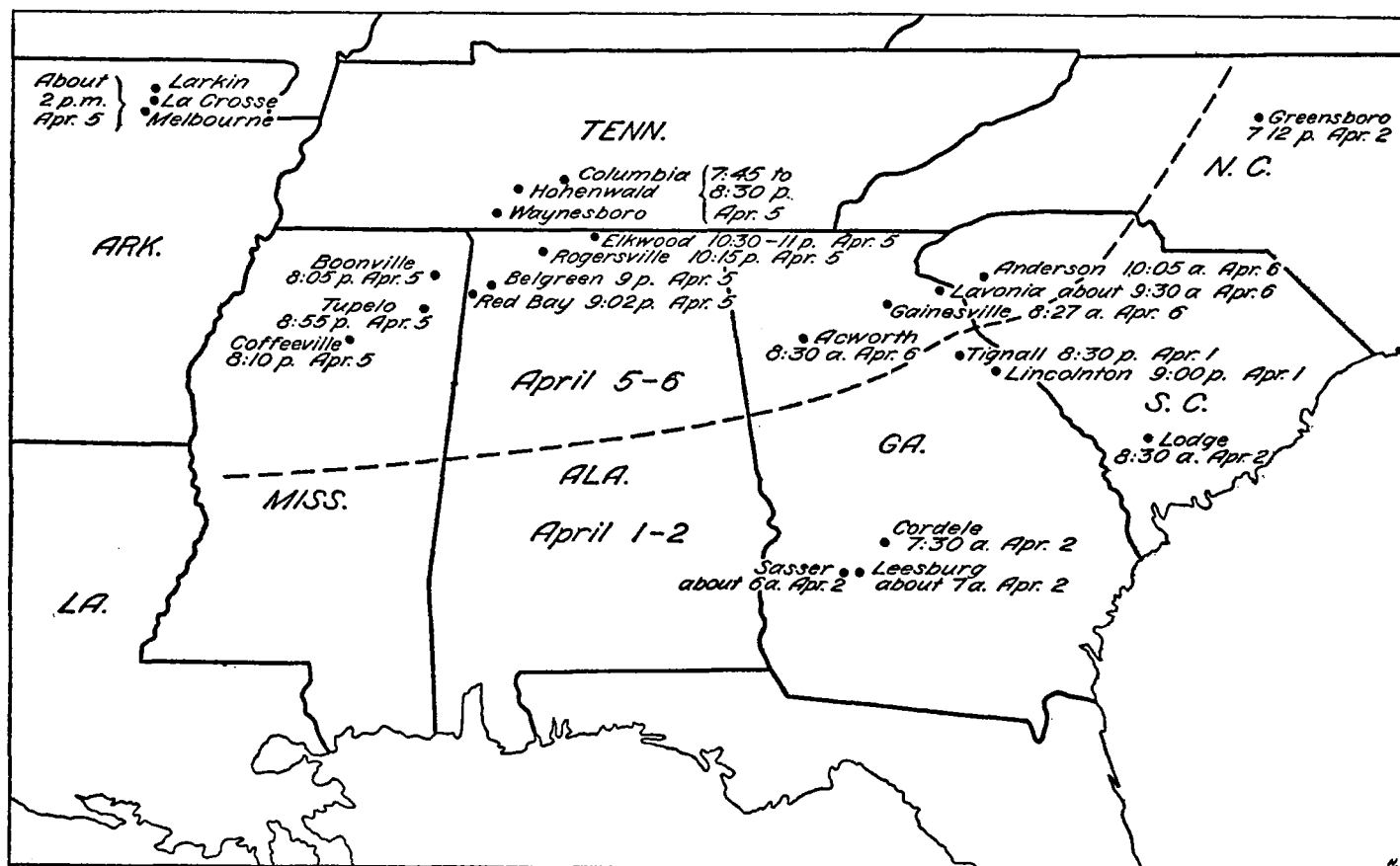


FIGURE 1.—Locations of tornadoes of April 1 and 2 and April 5 and 6, 1936.

worth of property. Later (exact time unknown) there was some damage by wind 3 miles north of Hillsboro, and the last trace of the storm was reported by J. F. Hunter, cooperative observer at Arcola, Warren County, N. C., who stated "a heavy cloud and loud roar passed north of me at 9:15 p. m."

SECOND SERIES

The second family of storms began in northeastern Arkansas on the afternoon of April 5. Tornadoes were reported about 2 p. m. at Melbourne, La Crosse, and Larkin, all nearby. One person was killed at La Crosse and 4 injured; estimated property damage in the three localities was \$40,000.

The next outbreak was reported from the middle Tennessee River Basin in Tennessee, in Hardin, Wayne, Lewis, and Maury Counties, or in the vicinities of

\$10,000 in property destroyed. Quickly following this, and apparently the same storm that struck Coffeyville, a very disastrous tornado occurred at Tupelo, Miss., some 60 miles to the northeast, at 8:55 p. m., causing appalling loss of life and between 3 and 4 million dollars of property destruction; 216 people were killed, and 700 injured at Tupelo and in its vicinity.

The Tupelo, Miss., tornado is reported to have occurred at 8:55 p. m., April 5, while a similar storm struck Red Bay, Ala., near the Alabama-Mississippi State line, and about 35 miles northeast of Tupelo, at 9:02 p. m. the same day. Other points in northeastern Alabama reporting tornadoes about this time were Belgreen, 9 p. m.; Rogersville, some 40 miles to the northeast, at 10:15 p. m.; and Elkwood, about 35 miles from Rogersville, and near the Tennessee line, between 10:30 and 11 p. m. It is not clear that one and the same tornado occurred at all these

places. There may have been more than one, but, if so, they all occurred between 9 and 11 p. m. At Red Bay, 8 persons lost their lives and 50 others were injured, while at Elkwood, 4 people were killed and 3 injured. Loss to property, in and near Red Bay, is estimated at \$150,000, and at Elkwood, \$5,000. Other "straight" winds were reported about this time in northeastern Alabama, especially near Tuscumbia and Florence, with property damage estimated at \$7,500. One person was killed near Tuscumbia.

No tornadoes were reported between 11 p. m. on the 5th and the early morning of the 6th, when the greatest disaster of the entire series occurred in northern Georgia.

turing centers; but Gainesville, population nearly 9,000, is also the location of Brenau College for Girls and the Riverside Military Academy for Boys. The storm was attended by winds of most violent force, which utterly demolished about 750 houses and badly damaged more than 200 others, almost completely destroying the business district of the city. The loss of life reached the appalling total of 203, while 934 others were injured.

Evidence indicates that the Gainesville destruction was probably the work of three distinct tornadoes occurring almost at the same time. Relative to this aspect of the catastrophe, George W. Mindling, Section Director for Georgia, makes the following comments:

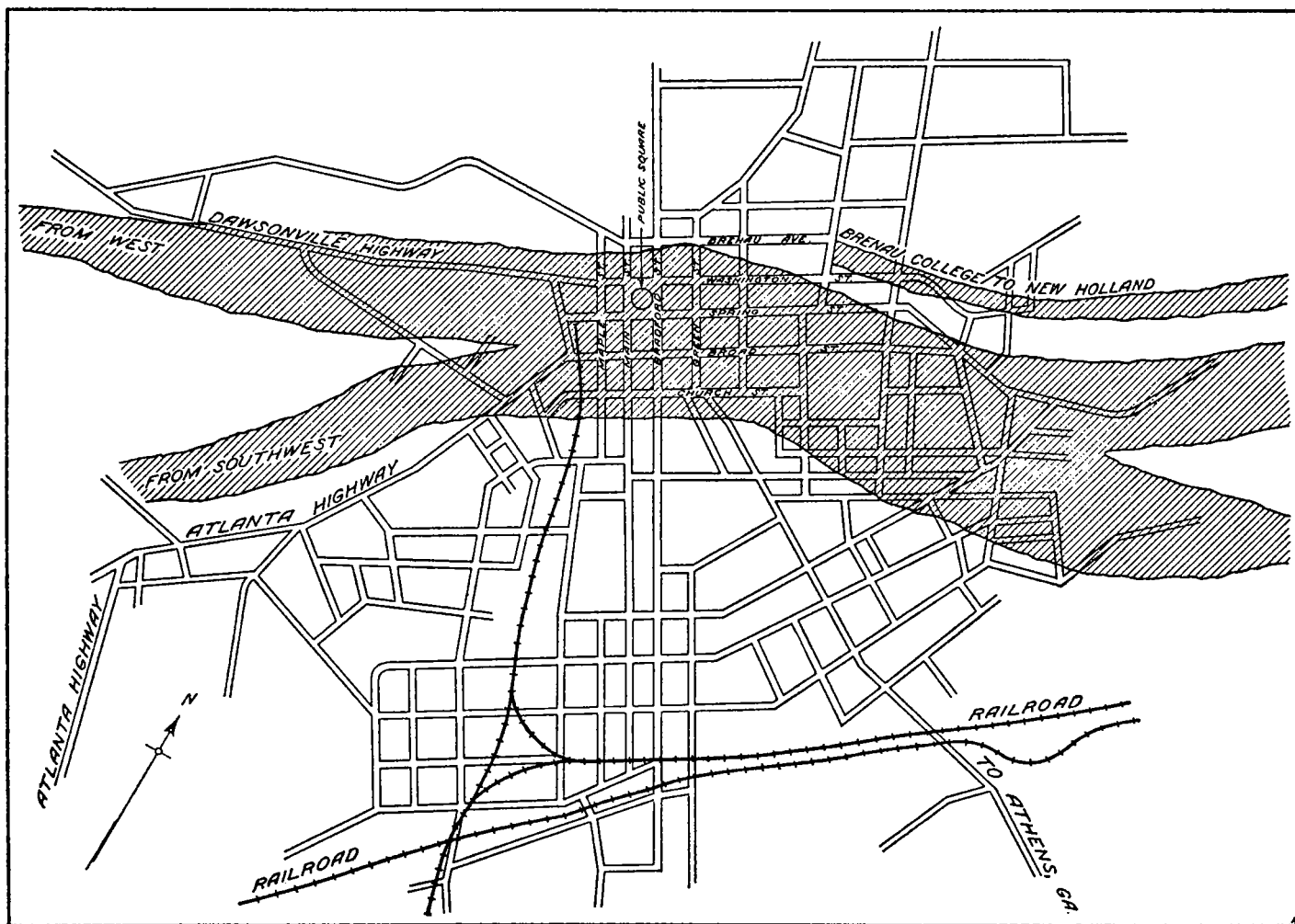


FIGURE 2.—Areas in Gainesville, Ga., devastated by tornadoes, April 1936.

About 8:30 a. m. of this date, one occurred about a mile north of Acworth, where a store, a grist mill, and two houses were completely demolished and other buildings damaged. Two women were injured. This tornado moved northeastward (in the direction of Gainesville) with a comparatively narrow path. About 8 miles east of Acworth a church and two farmhouses were destroyed. However, if the time of occurrence is correctly reported, this could not have been the same storm that caused such havoc at Gainesville, for the latter is definitely known to have occurred between 8:27 and 8:37 a. m., or approximately the same time as the Acworth disturbance, some 50 miles to the southwest. At Gainesville and New Holland one of the greatest tornadic disasters ever known in this country occurred. Both of these are manufac-

"Apparently, the first storm struck the campus of Brenau College about 8:27 a. m., the course of destruction being a narrow path extending nearly east from there through New Holland, thence northeastward into the country. The others came along 10 minutes later, two distinct funnel-shaped clouds appearing at once, as witnessed by a furniture dealer and by the mayor. These destroyed all but a few buildings in the business section. In the Western Union office, which was wrecked, the time stamps were stopped at 8:37 a. m., eastern time. One course of destruction led into the city from the southwest, just to the west of the Atlanta highway; the other came in from nearly west along the Dawsonville highway. These two paths came together west of Grove Street, and an area four blocks in width was laid waste clear across the

city, beyond which separate courses of destruction again appeared.

"Where the tornadoes finally disappeared is uncertain, but Lavonia, Ga., nearly 40 miles from Gainesville, experienced a tornado about an hour later, and Anderson, S. C., also had one on the same day. These places are nearly on a direct line east-northeast from Gainesville. However, reports of destruction at intervening points are lacking." See figure 2.

Probably the storm at Gainesville was the same one that was reported at Lavonia, Ga., about an hour later, and finally reached Anderson, S. C., nearly 70 miles north-east of Gainesville, at 10:05 a. m. If so, it traveled some 70 miles in approximately 90 minutes. Estimated damage at Lavonia was \$10,000, but there was no loss of life. The width of the path at Anderson and vicinity was from 400 to 500 yards. Property damage was estimated at \$250,000; about 50 homes were wrecked in the Anderson and Appleton Mill villages, and some houses in the Evans section destroyed. The tornado barely missed the business section of Anderson. Only one person was reported killed, but 30 were injured.

The group of tornadoes comprised in these two series, considering the number of people killed and injured, and the property damage, probably ranks third in destructiveness in the tornado history of the United States. In the first series of April 1-2, about 41 persons were killed and 540 injured; in the second, April 5-6, some 452 persons lost their lives and 1,775 were injured. In comparison there is a record of a series of tornadoes, supposed to have included some 60 separate storms, which occurred in several Southern States in February 1884 with an estimated loss of some 800 lives. Another outstanding tornadic disaster was the so-called "Tri-State" tornado of March 18, 1925, which occurred in the Middle West and caused more than 700 deaths, and in which some 3,000 persons were injured.

The paths of great tornadic destruction are so narrow and their occurrence so erratic that it is unusual for a

locality, in the course of years, to be visited twice by such storms. However, this does happen occasionally. Two other tornadoes are known to have occurred in Gainesville, or vicinity, in past years. One of these was on March 25, 1884, destroying several houses and killing one or two persons. The other, on June 1, 1903, was much more destructive, with 98 people losing their lives; property damage was estimated at about a million dollars. In connection with the Gainesville storm, Mr. Mindling submits the following comments:

"The question has often been raised as to whether buildings of heavy, solid masonry and office buildings with strong steel framework may be expected to stand up under the full force of a violent tornado. The results at Gainesville give a good deal of assurance in favor of such structures. The city has a few such buildings, among which are the First National Bank, the Jackson Building, the post-office building, and the Baptist Church. These came through with only shattered windows and other minor damage, while less rigid structures around them were generally demolished. Even the more substantial brick buildings of recent construction crumbled around those named, of which only the church suffered much. It was partially unroofed and its interior damaged where wreckage fell in, but the heavy stone walls were not hurt.

"A very substantial stone monument 20 feet high and bearing a metal statute of a Confederate soldier came through unharmed on the Public Square at the very center of most appalling destruction. At the corner of Green and Washington Streets, just a few feet from the northernmost corner of the post-office building, a massive marble monument was broken to pieces and parts of the basal structure were carried away, including a block of granite about a foot thick and about 9 by 6 feet in length and breadth. This illustrates the violence of the wind that was brought to bear upon the post office and the Jackson Building next to it. The Baptist Church is just across the street from the wrecked monument."

THE NEWFOUNDLAND FOREST FIRE OF AUGUST 1935

By EARL B. SHAW

[State Teachers College, Worcester, Mass., February 1936]

August 13, 1935, was a day of misfortune for owners of timber land in north-central Newfoundland, and nearly brought tragedy to the town of Grand Falls. To the student of climate, the fire, which in a few days swept many square miles of forest, offers an interesting illustration of the importance of weather conditions for conflagrations. The writer, who was in Grand Falls during the middle of August, became greatly interested in the atmospheric relationships that were evident throughout the catastrophe. Personal observations and data furnished by residents of Grand Falls upon weather and daily progress of the fire, have made possible the following study of the relation of meteorological conditions to the start, expansion, and final extinction of the blaze.

Summer is the season of greatest fire danger in the timber-covered island of Newfoundland. At this period of the year, insolation not only removes the protecting blanket of winter snow, but also warms the air and lowers the relative humidity. The result is a dry forest bed and a dry atmosphere which make the fire hazard far greater

than that of the cold season. The summer weather of 1935 increased inflammability in the forests even more than usual. Lower than average precipitation and relative humidity, and higher than average temperature and barometric pressure combined to produce exceptionally favorable conditions for fires.

Although the total precipitation for the first 7 months of the year was 3.88 inches¹ above normal (27.37 inches compared with a normal of 23.49 inches), the amount for June and July was 1.4 inches below normal (5.5 inches compared with a normal of 6.9 inches); and during the first part of August little more than a trace of rain fell. Moreover, the number of rainy days in June and July was the lowest on record, seven below normal.

¹ Official long time climatic data are exceedingly difficult to obtain in Newfoundland. Few official stations have a comprehensive record over a number of years. There is no Government weather observer in Grand Falls, but the statistics used in this article were furnished by a local firm that has kept careful records on certain climatic elements for 8 years. The writer checked these records with those which he procured from the Buchans Mining Co. at Buchans, a mining town approximately 50 miles to the southwest, and a close correlation was evident in most cases. The latter company has recorded weather data for a period of 5 years.